Draft Plan for PIER Research in

Strategic Energy Related Science and Technology

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Note: This plan remains a work in progress and is distributed to facilitate public input and comment.

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Introduction

Strategic Research Overview

In restructuring California's electricity industry, Assembly Bill 1890 also authorized $61.8 million annually for 4 years for public interest energy research. Senate Bill 90 created the PIER program and established 5 subject areas for public interest energy research: Renewable Generation; Environmentally-Preferred Advanced Generation; Energy-Related Environmental Research; End-Use Energy Efficiency; and Strategic Energy Research. The mission of the PIER program is to : *Provide public interest RD&D which improves Californians' quality of life by providing cleaner, safer, more reliable, more affordable energy*. This section discusses research under the subject area of Strategic Energy Research.

Under the restructured electricity market, critical infrastructure changes are necessary to allow transactions to be made in an efficient, effective, reliable and environmentally acceptable manner. The electricity infrastructure includes generation, transmission, distribution, control and communications technologies covering generation to end-use, all functioning in an integrated cohesive fashion. The existing infrastructure does not currently have the technologies available to facilitate a market likely to be characterized by many more participants making and implementing many more decisions about electricity production, distribution and use.

Strategic energy research was identified in *the Strategic Plan for Implementing the RD&D Provisions of AB 1890* and in SB 90 as a critical component of a balanced public interest research portfolio. The strategic program area includes 1) enabling technologies to improve infrastructure responsiveness, efficiency and reliability 2) technologies capable of providing all customer classes with meaningful access to the benefits of restructuring while minimizing transaction costs, 3) techniques and technologies which can appropriately respond to volatility in prices helping improve the functioning of the market, and 4) cross cutting research (that which affects multiple sectors and/or provides opportunity to energy and non-energy sectors, and 5) longer term, basic research.

Improving the electric systems reliability is of particular importance because of the significant role the system plays in maintaining economic growth and environmental enhancements. Without a reliable system many cleaner electrical generation sources will not have access to buyers of their electricity, high value added jobs in high-tech industries are jeopardized, and other benefits of restructuring may be lost. As one example, the outage experienced in August 1996, accounted for several billion dollars of loss to the California economy. The legislature recognized the particular strategic relevance of system reliability in SB 90 " (T)he program shall consist of a balanced portfolio that addresses California's energy and environmental needs, technology opportunities, and system reliability." (PRC section 25620.1 (b), emphasis added)

The advancement of energy technologies requires the active and creative cooperation of many distinct entities including agencies, industries, universities, and market participants. While progress might occur in the absence of collaboration, the progress will be accelerated and made more likely. Research is required on innovation organizational approaches that establish collaboration between the sources of advance energy technologies (agencies, industries, universities) and the deployment and commercialization of those technologies (market). A product of such collaboration should include education at all levels, in order to promote advanced generation as well as providing a work force for the future. Increasingly, the market and technology requirements for significant advancement will be broad and interdisciplinary requiring innovative and collaborative efforts.

Recent experience in California's new electricity market illustrate that customers are seeking differing levels of various attributes (reliability, power quality, price, etc.). Generators and other energy service providers are also diversifying offerings. One experience, the significant, albeit temporary, run up of prices paid for ancillary services, identifies the importance of increasing the ability of customers to bid demand into the market while increasing price elasticity in the short term. Further, price volatility has shown to be increasing, while average prices are decreasing.

Currently, the ability of customers and energy service providers to make diverse decisions is often hampered by the fact that, generally speaking, electricity cannot be stored; it must be generated and used instantaneously. This also contributes to the need for complex and, somewhat controversial, centralized control strategies for operation of, and payment for, the use of the transmission and distribution grid.

Further, electricity is likely to become more substitutable with other energy forms and inputs of production (the phenomenon of "convergence") as a short run marginal alternative (i.e. operational choice) in addition to long run alternatives (i.e. capital investment choice). This convergence will likely will increase the number and diversity of electricity transactions, as well as electricity-for-other-commodity transactions.

Overview of this Section

Part 1--This draft plan for strategic energy research first describes seven broad issues identified for the strategic program. Some background information on each issue is provided to explain the issue along with specific technological aspects associated with each. Overall program goals are discussed as well as specific goals and objectives for each of the strategic issues. Roles are described for the PIER program, representing proposed research activities.

Part 2--Current PIER program funding (from Transition and 2nd general solicitation) is identified, correlated to each of the strategic program issues.

Part 3--Provides proposed Calendar year 1999 funding and procurement approach and schedule.

Part 1: Discussion of Issues

Issue 1: Technologies need to be developed to facilitate the expanded use of distributed energy resources, including interconnection, inverters, and other system controls as well as predicative models. The impact of wide-scale grid-connected distributed energy resources on the dispatchability of resources and the integrity of distribution and transmission system needs to be determined.

Overall Goal: By 2010, 20% of California electrical demand will be met by distributed energy resource (including supply and demand management) technologies.

Technical Opportunity

Opportunity 1:

Interconnection and other control systems need to be developed to facilitate use and penetration of distributed generation

Goal 1: Improve ease of interconnection and system control

Objective:

Determine interconnection communication requirements for distributed generation resources and develop communication hardware and software.

Strategic Activity:

Determine institutional and market barriers for distributed generation including interconnection and safety barriers and work with stakeholders to demonstrate interconnection systems and mitigating measures that overcome barriers. (Targeted Solicitation)

Develop monitoring , communications and dispatch systems for distributed generation resources. Research develop and demonstrate advanced technology for plant monitoring that applies to distributed energy resources to improve the safety, economic efficiency, operability of distributed generation and reduce down time for maintenance requirements, and for improving economic efficiency. (Interagency Agree.)

Goal 2. Develop predictive models that determine performance of distributed generation in the competitive market including dispatchability and reliability (system integrity) impacts

Objective:

1. Determine dispatchability and impact on system reliability of distributed generation technologies.

Strategic activity:

Develop and demonstrate network level communication and control systems that integrate distributed generation technologies with generation, storage, and substation distribution automation components. Validate the interaction of the components within the system and the dispatchability and operability of distributed generation to reduce barriers to distributed generation systems. (Targeted Solicitation or Interagency)

Goal 3: Advance development of distributed energy resources with significant economic and environmental benefit for widespread application in California.

Strategic Activity:

Determine the requirements for competitive entry for key distributed resource technologies in each application and sector.
Develop criteria to assess environmental impacts and associated economic benefits of distributed resources
Develop DER technologies (in conduction with program descriptions in renewables and advanced generation)

Issue 2: In the deregulated electricity market today, wholesale electricity prices tend to increase with electricity demand; generally, the higher the demand, the higher the wholesale price. However, retail prices do not yet reflect these wholesale price fluctuations. Almost all final consumers have established rate schedules. Some large consumers have rates that vary with the time of day but, even in these cases, the rates do not reflect actual wholesale price. This situation limits the efficiency of the new electricity market. Decision making will gradually be decentralized and moved closer to the final consumer of electricity. In a well-functioning market, consumer decisions will be made in response to price signals that better reflect costs and customer's' individual needs for various components of electrical service (such as the level of power quality or ability to defer consumption.) In an ideal situation (and in a truly free market) decision making would have no artificial barriers in accessing the necessary information to the implementation of decisions. While some costs for making and implementing decisions (transaction costs) are inevitable, there appears to be an opportunity to reduce these costs significantly through improved communications and control technologies. Improved communications protocols are needed to reduce transaction costs for small customers, including demand bidding and load management. Information alone, however may not be enough if a customer is unable to discern what the information means and how it could be used. An array of technologies and techniques are needed to create an infrastructure that can facilitate decision making in the real-time market, the day-ahead market (where most of the volume is today), and in longer-term futures markets (where demand is expected to grow). Advanced technologies are needed to facilitate seamless two-way communication of real time pricing information and responsive demand-side behavior. There is also the need to guarantee privacy, integrity, security, speed, and appropriate accessibility of data. In the deregulated market decision making will gradually be decentralized and moved closer to the final consumer of electricity. Information alone, however may not be enough if a customer is unable to discern what the information means and how it could be used. A array of technologies and techniques are needed to create an infrastructure that can facilitate decision making.

Technical Opportunity

Opportunity 1: Improved communication systems are needed satisfy the information requirements of direct access

Goal 1: Develop improved communication infrastructure to facilitate direct access and metering technologies to permit real-time pricing information to drive transactions. By year 2003, 50 percent of all large industrial and commercial customers will have advanced metering & communications technologies which allow for real-time market participation.

Objective:

Determine communication infrastructure requirements for direct access

Strategic activity:

1. Define and develop communication interfaces, data formats and security procedures to ensure that electric service providers, distribution companies and customers can securely exchange data systems and mitigating measures that overcome barriers. (Targeted Solicitation and Membership)
2. Develop advanced communication technologies to facilitate two-way real time pricing transactions (Targeted Solicit and Co-funded)
3. Research, develop, and demonstrate advanced metering technologies. (Targeted Solicit and Co-funded)

Issue 3: Storage Technology. Multiple applications and a variety of customer classes that can benefit from electricity storage holds bestow storage technology the status as a strategic technology . This near-universal application of storage technologies poses some challenges and also opportunities for its development under PIER. There are a variety on storage technologies - and all of them are not mutually exclusive. Though all involve electrical storage over a range of duration and size, the applications are diverse. The potential uses and include power quality improvements, load leveling, load management , provision of ancillary services or dynamic benefits and plain storage of electricity when none is available at a desired time, place or price.

Storage technologies augment the infrastructure necessary to increase consumer choice in obtaining electrical services (power quality, load management) and to enhance system reliability (availability, dispatchability.) The economics and other characteristics of energy storage technologies need to be improved as an alternative to generation and/or transmission, system control, and load management, and power quality capabilities, particularly industrial and commercial. Storage technologies may address power quality related problems, which can have significant economic and reliability impacts.

While not limited to storage technologies, there are three aspects of power quality that the PIER program is concerned with:

1. maintaining a minimum level of quality at the distribution level (working in cooperation with utility distribution companies) incoming to individual consumers,
2. reducing the outgoing negative effects on grid level power quality from individual customers, and
3. improvements to processes and operations which would make them less sensitive or better able to deal with less than perfect quality

The Strategic Research PIER program element will include those issues related to power quality from the grid, and the issues of power quality problems that industrial operations send back to the grid from the process operations. The focus of the industrial/ag/water program element will be on improving processes to be less sensitive to power quality problems.

Overall Goal: By 2003 at least one technology will be commercially ready (i.e. offered at competitive price, available suppliers and supporting service infrastructure) which provides customers an option (as opposed to buying these services from an Energy Service Provider) to obtain on-site power quality and load management capabilities.

Technical Opportunity #1 Lack of ability to compare energy storage systems to determine capabilities and applications of various technologies (such as load management and power quality improvement devices) as un-interruptible power systems.

Goal 1: Improve capabilities of and the ability to compare energy storage systems
Objective:

Compare, contrast and publish the important parameters of various energy storage systems , UPS and power quality capabilities of various power storage systems

Strategic activity:

Develop a test site and methodologies for testing and comparing various energy storage systems. Determine cost and benefits of applications of storage devices for use as UPS and in power quality applications. Determine environmental, institutional, technical and market barriers for wide spread application of energy storage devices as and alternative to transmission system control and load management. Propose measures to overcome such barriers. Technologies may include but not be limited to chemical batteries, Flywheels, Ultra capacitors, Superconducting magnetic energy storage, and other devices. (Interagency Agreement combined with Targeted Solicitation)

Technical Opportunity #2 The deregulated market creates new opportunities for use of storage technologies. Accelerated use of storage technologies by customers, however, requires RD&D to reduce costs and improve reliability of storage technologies, and increase demonstration to facilitate seamless integration of the technologies with the electric grid.

Goal 1. Develop and improve energy storage devices to improve UPS and power quality capabilities.

Objectives: Research and develop advancements in existing, evolving and new energy storage technologies

Strategic activity:

Research, develop and demonstrate advancements in Battery, Flywheel, ultra-capacitor, and other energy storage technologies for application as UPS and power quality improvement devices. (undefined)

Develop integrated storage technologies (flywheels, batteries, modular hydroelectric) and system integration concepts to enhance reliability of transmission and distribution systems. (undefined)

Improve the cost of storage technologies for use in enhancing the availability, reliability and disptachability of intermittent energy sources (varied)
Component R&D to reduce the cost and increase the reliability of storage technologies. (Targeted solicitation)

Determine the economic and physical value of storage in the deregulated market place and also as a distributed energy resource. (Interagency Agreement and Membership)

Develop storage to the point it can be used as an option in deregulated market to provide ancillary services in area of power quality, availability and load management. (Targeted Solicitation)

Who are the beneficiaries of this work? ESPs, Consumers, System operators, Utilities, Industrial, Commercial and residential customers who can respond to price signals, concerned with power quality and those who want to purchase unbundled electrical services. .

Issue 4: Technologies need to be developed to make the electricity system more robust in the event of natural disasters (e.g., earthquakes, windstorms, floods); to suffer less damage and/or to reduce restoration time.

Technical Opportunity One: Seismic technologies

Goal 1: Improve understanding of earthquake hazards, the nature of the damage caused, the design and engineering methods to mitigate the damage, to assess the functionality of the system (and prioritize decisions regarding retrofits and upgrades), and to reduce restoration times. By 2010, reduce expected loss of capital plant and system facility from catastrophic events (high risk seismic, high risk flood and windstorms) by 25% by improving the tolerance of facilities to such events.

Objectives:

1. Improve understanding of earthquake hazards, the nature of the damage they cause, and design engineering methods to minimize damage.

Strategic Activity:

In partnership with PG&E and the Pacific Earthquake Engineering Research Center, provide funds to continue multi-year efforts to understand and identify the failure modes via equipment analysis and testing, and develop appropriate design and engineering solutions to mitigate the potential for damage. (sole source)

Develop methodologies to assist infrastructure decision making regarding retrofits and upgrades and develop technologies to improve the robustness of the electric system following seismic events.

Develop statistical methodologies to assess the functionality of the electric system following a seismic event. (Interagency agreement, Targeted solicitation, or membership)

Develop technologies to reduce damage and improve restoration time. (Interagency agreement, Targeted solicitation, or membership)

Objective no. 1: Starting Quarter
With respect to Objective no. 1 above, the Energy Commission is currently providing $1 million in PIER Transition Program funding to PG&E, which is passed to the prime contractor, the PEER Center. PG&E is providing 1000 hours of in-kind labor. This work is scheduled to end 3rd quarter 1999. In order to maintain continuity of research, work should begin no later than 4th quarter 1999.

With respect to Objective no. 2 above, the results of PEER Center Phase I work, as well as the PEER Center Phase II work being funded by the PIER Transition Program, provide input to meeting that objective. However, it is not necessary for the PIER Transition Program work to be completed before beginning such work (e.g., PG&E has already begun such an effort on a small scale.) This work can begin 3rd quarter 1999.

Objective no. 1: What research should the Commission be proposing?
To meet Objective no. 1, the appropriate role for the Commission is to continue funding the multi-year PEER Center research, subject to appropriate oversight (currently the Joint Management Committee for the User-directed Applied Research Program for Electric Utilities, consisting of PEER Center, PG&E, and California universities, evaluates and approves the research proposals. PG&E monitors the research progress and transfers the research results to its operating groups as well as the Inter-utility Seismic Working Group and others.)

To meet Objective no. 2, the Commission should supplement the scoping level work currently being done by electric utilities to enable them to develop practical tools for assessing seismic risk.

Options to procure work
With respect to Objective no. 1, a sole source contract with PG&E may be the most effective means of continuing the existing work currently being funded by the PIER Transition Program. while maintaining necessary electric utility involvement for ultimate market application.

With respect to Objective no. 2, an interagency agreement would be the most effective method.

Who are the beneficiaries of the work?
All California electricity consumers benefit from the insurance provided by a more robust electricity system in the event of an earthquake.

Opportunity Two: Other Natural Hazards

Goals: Reduce network down time during natural disasters
Objective:

Develop technologies that reduce restoration times

Strategic Activity:

Develop and demonstrate methods and technologies that reduce outage time and improve restoration time during natural disasters including effects on and mitigation for the local and WSCC-wide systems. (membership in collaboration with CaISO)

Develop improved fault detection and reporting devices (membership or Targeted solicitation)

Issue 5: Advanced technologies are needed to improve the reliability, operability and efficiency of the transmission, distribution, and delivery grid, in conjunction with the research undertaken by the regulated market. This is one of the most important issues to achieve customer satisfaction and public health and safety across all scenarios as penetration of reliable distributed resources increases. In addition, improved operability and capability of the existing transmission system have cross cutting benefits including avoiding the need for additional transmission corridors, which are more difficult to site and have significant visual and environmental impacts (note that biological impacts in transmission corridors is addressed in the environmental resource area.) Advanced system technologies can contribute directly, immediately, and in a long lasting manner to reduce energy costs and improve system reliability for all customers under the deregulated environment.

Technical Opportunity
Opportunity 1: Power delivery system reliability and efficiency need to be improved to ensure the competitiveness of the marketplace and the safety of utility workers and the public

Goal 1: By 2002, reduce California Independent System Operator (ISO) outage duration cap from 72 hours to 60 hours through improved maintenance and restoration technologies and advancements in system performance that reduce the effects and limit the scope of system disturbances due to normal circumstances such as wind, trees, small animals, lightning, car/pole and airplane accidents, and other disturbances as included in performance measures computed by the ISO. Currently, the affect on utility performance of a prolonged outage is capped at 72 hours. Restoration time improvements should make the 72 hour outage an extreme anomaly, permitting the cap to be reduced to 60 hours, there by improving ISO performance. Note that natural disasters such as earthquakes are exempt from performance calculations, and are addressed in Issue 4.

Goal 2: By 2008, increase the market penetration to 10% for products that improve the energy efficiency of the power delivery system by improving the individual efficiency of conductor, transformer and other system elements by 8% or greater, compared to 1998 standard design.

Objective:
Develop technologies that improve system efficiency and system resistance to failure

Strategic activity:
Identify, develop and demonstrate technologies that improve safety reliability and capability and reduce transmission and distribution system losses. Determine the effects of distributed utility on system efficiency, safety and reliability and on environmental impacts versus transmission system expansion.

Identify, develop and demonstrate technologies that improve high efficiency and more reliable overhead and underground conductors (on-going work and sole source extension combined with targeted solicitation)

Develop and test equipment for widespread application using high-temperature superconducting materials to increase system efficiency and overload resistance, in transformers, bearing application and storage devices. (Targeted solicitation co-funded with DOE)

Identify, develop, and demonstrate on-line system programs that will enable the grid to be operated closer to its transfer capability limits without compromising system reliability or security.

Identify, develop and demonstrate technologies that improve methods of construction and reconstruction as well as new methods, procedures and tools for use in maintenance and operations to improve safety, reliability and reduce environmental and land use impacts.

Issue 6: There is a need to maintain long term, cross cutting and innovative advancements of science and technologies whose future applications may be unclear today. Cross cutting research should address and balance opportunity and benefits in multiple program areas. Development of energy-related technologies that enable multiple applications of strategic importance is especially critical.

Technical Opportunity:

Opportunity 1: Development of energy-related technologies that enable multiple applications of strategic importance is especially critical.

Objectives: Improve the capabilities of supply and demand resources to compete effectively in a more volatile pricing regime.

Strategic activity:

1. Develop improved model to enable short-term forecasts of weather conditions that will improve the economic efficiency and reliability of transmission and generation facilities by improving heat storm prediction, wind flow, solar indicator, storm, lighting and prediction of other conditions that increase the system operators' ability to respond to system conditions and increase the ability of decision makers for supply and demand bidding to correlate with next-day market conditions . (Targeted solicitation)

2. Develop, test, and evaluate applications of distributed load control devices ('smart chips') to maintain local and regional voltage support and other ancillary services as an alternative to generation and central dispatch/control , and "***RMR"*** contracts. (interagency agreement)

Cross-Cutting Energy Technology Research

What research should the Commission be encouraging?

Goals and Objectives:

- Identify technologies which have multiple sector applications and can make significant impacts on energy cost, consumption or environmental impact
- Identify enabling technologies that directly impact energy cost, consumption or environmental impact. An example of such a technology is superconducting, magnetic energy storage.

Who are the beneficiaries of this work?

Benefits will likely be long-term (e.g., greater than 5 years) and will accrue to ESPs, consumers

Energy Innovations Small Grant Program

Companies working in efforts eligible for grant funding

- Academic institutions
- Small Businesses
- Individuals
- Small non-profit institutions

Options to procure work

Grants up to $75,000 will be awarded to accomplish the work.

Who are the beneficiaries of this work?

Benefits will likely be long-term (e.g., greater than 5 years) and will accrue to ESPs, consumers, system operators, and utilities.

Issue 7: There is a public interest need to develop advanced mathematical models to better analyze and undertake research on the market structure(s) within which electricity transactions occur, evaluate the performance of the market and associated signals for technological innovation, and identify how electricity related technologies may function within the market.

The benefits of energy technologies may never be fully realized by the California ratepayer until there is a significant penetration of technologies and policies that reduce the cost of electricity, benefit the California economy, create jobs, and/or reduce environmental impacts of energy generation in the state. The coordination with collaborative research activities to enhance the transfer of technologies and policies from the research and development laboratories to economic viability and commercialization are key to accomplishing this.

Technical Opportunity #1: Market signals and models for determining how new electric technologies will perform in the market need to be identified and developed. Such tools are needed to aid developers of small distributed generating systems and other technologies to evaluate project benefits and risks.

Goal: Identify performance indicators and information requirements for evaluating the benefits and risks of distributed generation and other technologies in the restructured market place. Provide the necessary tools and technical information that will assist new technology developers sufficient understanding of the differentiated needs of the electricity system as it transitions to a more competitive market.

Objective: Develop analytic models that can be used to evaluate the economics and relevant system benefits of distributed generation and introduction of other technologies to the electricity market.

Strategic activity:

Develop model(s) that operators of distributed generation resources can use to evaluate the economics of a project in the competitive electricity market The solution should address the availability of information for strategic level decision making for distributed generation operators. (interagency or membership)

Develop or modify existing models that evaluate costing mechanisms for maintaining system stability, including the means for avoiding and suppressing system oscillations, system control apparatus and methodologies, and voltage collapse monitors. (interagency or membership, in conjunction with CaISO)

Develop the expertise and models that simulate collaborating adaptive agents, given the infrastructure of the competitive electricity market. Agent-based modeling simulates the operation of a complex market system and evolving market strategies by the individual participants. This approach is particularly valuable to explore the impacts of different sets of market rules governing the operation of a system, changes in the physical system, or changes in the motivations and capabilities of participating agents. (interagency agreement and membership)

Evaluate the impact on overall prices and prices for ancillary services from modified bidding protocols in the power exchanges. In particular, evaluate and simulate various (in conjunction with adaptive agent models) auction styles in comparison to the current "second price auction."

Goal 2: Demonstrate the effectiveness of a focused research and development effort which garners California stakeholder participation, cooperation and collaboration and which eventually leads to the successful commercialization of one (1) energy technology.

Objectives

- Provide a "bridge" between existing academic, laboratory, industrial, and consumer interests in the state of California to develop commercially viable, environmentally sensitive energy technologies.

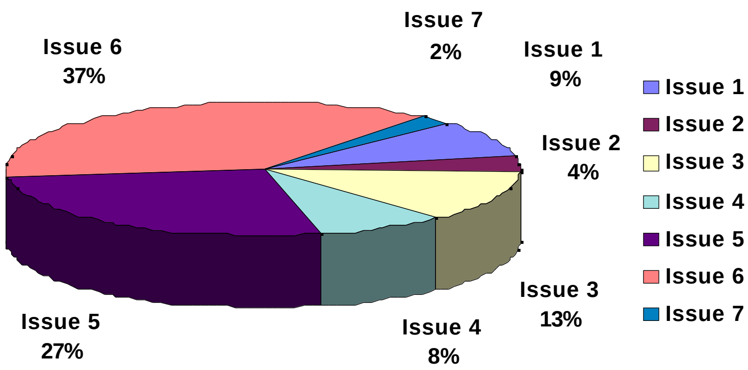
- Ensure the market connectedness between industrial entities and the research, development and demonstration efforts accomplished at Universities and industrial and government research centers.

Section 2--Existing Funding

This section provides a listing and correlation of projects already funded under the PIER program to the seven issues discussed in section 1. While projects listed as "second PIER solicitation" have not all completed contract initiation, they have been approved by the full Commission. (readers note: One additional project, by Schaefer Corp. has been upheld on protest; it is currently undergoing review and consideration) Projects funded through the "transition" solicitation are identified with a superscript "T", while those from the second general solicitation are identified with a superscript "2".

- [T]SDG&E, ***Dynamic Line Rating* Policy ---Issue 5**
- [T]PG&E, ***Electric System Seismic Safety and Reliability* ---Issue 4**
- [T]SDG&E, ***System Stability and Reliability* ----Issue 5**
- [T]Edison Technology Solution, ***Phasor Measurement Units* --Issue 2**
- [T]Edison Technology Solution, ***USAT MOD2* ---Issue 2**
- [T]Edison Technology Solution, ***Energy Source Stabilizer (ESS)*-- Issue 3**
- [T]Edison Technology Solution, ***Substation Reliability* ---Issue 5**
- [T]CIEE***, Laboratory-Type Facilities* ---Issue 6**
- [E] Engineering Data Management, Inc., ***Development of a Real-Time Monitoring Dynamic Rating System for Overhead Lines*** **Issue 2**
- [2]W. Brandt Goldsworthy & Associates, Inc., ***Development of a Composite Reinforced Aluminum Conductor*** **--Issue 5**
- [2]Trinity Flywheel Power, ***2 kWhr Flywheel Energy Storage System* ---Issue 3**
- [2]Energy Compression Research Corp., ***Light-Activated Surge Protection Thyristor for Distribution System Reliability* ---Issue 5**
- [2]Material Integrity Solutions, Inc., ***Sagging Line Mitigator (SLiM)*--- Issue 5**

TOTAL FOR STRATEGIC PROJECTS: $6,226,047
BUDGET FOR SMALL GRANTS PROGRAM $2,500,000 --- Issue 6



Budget Breakdown of existing PIER Strategic Research

Part 3: CY 1999 Funding Proposed Allocations and Schedule

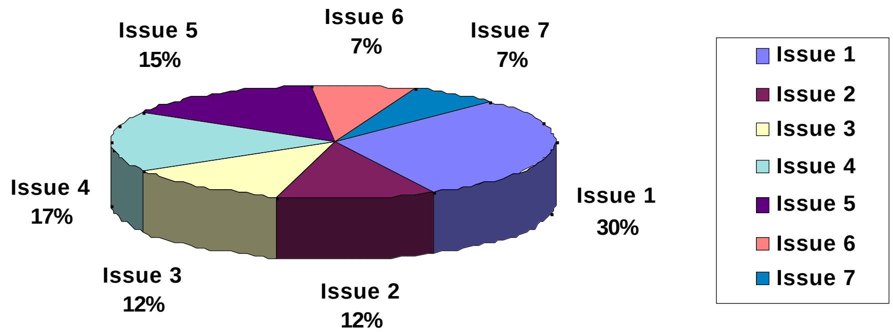
Based upon existing budget breakdown and considering relative priorities of the seven program areas, the Strategic team developed both proposed funding allocations (for CY 99) and procurement schedules.

Priorities in the Strategic Area were considered in light of the base line scenario and alternative scenarios. A key thread common to all scenarios was the need to improve information, communication and metering products to enable direct access, resulting in Issue 2 receiving the highest priority. The need to improve reliability and the operability of intermittent and distributed resources, as well as power quality and energy storage in times of system disturbance placed Issue 3 second in priority for the strategic area. Economic reliability and environmental pressures press the need for implementation of distributed generation into third place (Issue 1). System performance under catastrophic events and system reliability maintained status quo in importance in all scenarios, while mathematical models was determined to have the most value primarily during the period of transition to a more competitive market. Activity specific budgets were developed from contract proposals, work underway and staff estimates. Activity level budgets are not shown here. ***Future year budgets and work flows are being updated and will be made available as soon as possible***.

Proposed CY 1999 budget for Strategic Program Areas are shown in Table 1; and graphically depicted in Figure 2 (not including Small Innovators Grant Program). Figure 3 illustrates the proposed procurement start dates. These start dates represent anticipated solicitation **initiation** (i.e. release of RFP, identification of interagency agreement, negotiation for co-funded on-going projects etc.) Actual work would begin as soon as possible after procurement and contract documents can be completed.

		Strategic Program Area Research program	
		Draft Budget listing/ CY 1999	
Policy Issue			
1	Project/Program Short Title		
	Insti. and Interconnection		
	plant monitoring		
	communications and control		
		subtotal	**$4,200,000**
2	commun. interface		
	advanced metering	(existing EPRI)	
		subtotal	**$ 1,650,000**
3	Energy storage test site		
	RD&D storage technologies (2.4 million four years)		
		subtotal	**$ 1,700,000**
4	Earthquake infrastructure		
	post event functionality		
	fault detection and restoration		
		subtotal	**$ 2,400,000**
5	T&D system losses		
	High stregth conductors		
	superconducting transformers and apps.		
		subtotal	**$ 2,100,000**
6	short term weather		
	distributed load control		
		subtotal	**$ 1,050,000**
7	operational decison model		
	ancillary pricing		
	adaptive agent model		
		subtotal	**$ 925,000**
		Grand Total	**$ 14,025,000**
	Small Innovators Grant Program		**$ 2,500,000**

Table 1
Proposed CY 99 Budget for Strategic Area



readers note: the following figure is being updated to show anticipated work flow and budgets in years beyond CY 1999, and will be made available as soon as possible

Figure 2/Proposed CY 99 budget allocation
Schedule of Proposed Procurement Start Dates

ID	Task Name	Duratic
1	**Policy 1: Distributed Generation**	**129d**
2	Determine inst. & mkt. barriers	63d
3	Devel. monitoring, communications....	63d
4	Determine dispatchability	66d
5	**Policy 2: Improved communication protocols**	**132d**
6	Define & dev. comm. interfaces	66d
7	Dev. adv. metering technologies, 2-way	66d
8	RD&D adv. metering technologies	67d
9	**Policy 3: Energy Storage**	**196d**
10	Test site for energy st. RD&D	65d
11	RD&D battery, flywheel, ultra cap.	196d
12	**Policy 4: E System Disasters**	**260d**
13	PEERC continuing funding	65d
14	Seismic robustness	67d
15	Local & WSCC outage reduction	67d
16	Dev. fault detection devices	65d
17	**Policy 5: Adv. Reliability Technologies**	**196d**
18	RD&D to reduce trans. loses	196d
19	High strength conductors	132d
20	High T superconductors	65d
21	**Policy 6: Cross-cutting techs.**	**132d**
22	Short term weather forecast model	66d
23	Distributed load control devices	67d
24	**Policy 7: Adv. Mathematical Models**	**196d**
25	Econ. model for dist. gen	132d
26	Ancillary services costing concepts	130d
27	Adaptive agent modeling	66d